

Assessing the Completeness of Building Footprints in OpenStreetMap: An Example from Germany

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Abstract. Volunteered Geographical Information (VGI) has become a serious competitor to official data providers. The most successful project in VGI – OpenStreetMap (OSM) – has recently reached the number of one million contributors (January 2013). Over a billion nodes have been collected worldwide. Analyses of the OSM street network dataset have shown that the OSM dataset already outperforms the corresponding datasets of governmental and commercial data providers in some regions (e.g. Haklay 2010 et al. 2010, Neis et al. 2011). Consequently, business companies as well as research institutes have started switching to OSM. However, not all types of features are equally covered by OSM. Building footprints, for example, are still poorly mapped, but improvements may be expected in the near future as this feature type has currently a strong rate of growth. They are an important data source not only for urban development analyses or catastrophe management. Meinel et al. (2009) have shown how to use this type of data to derive various indicators to describe the urban structure in terms of the building types or the density dwellings and inhabitants.

As the completeness of the building data is a crucial precondition for such analyses, it is of high interest to investigate it within selected test regions. Unlike the already mentioned street network, the building footprints have not yet been analysed in detail. Therefore we introduce methods to measure the level of completeness of the OSM building data in comparison to the corresponding datasets of the German national mapping agency (ALK, ATKIS).

A simple method to analyse the completeness of the OSM building footprints is to compute their numbers and covered areas within small

regions and to compare these parameters with results gained from the reference dataset. Spatial patterns may be investigated with the help of administrative boundaries or regular grids as a common reference. However, this method is prone to differences of building footprint modelling and accuracy. Hence, more advanced methods that are based on object-based geometric comparisons are necessary. Thus, we introduce the 'centroid-method' and the 'overlap-method'. For the centroid-method the OSM building polygons are tested for intersection with the centroids of the building polygons of the reference dataset. By this method it can be inferred which building footprint of the reference dataset is represented in the OSM database. However, the reduction of polygons to points may introduce matching errors. Therefore, we also test the overlap-method, which estimates the degree of overlap of corresponding building polygons. A defined threshold (e.g. 50% overlap) decides if the building is represented in the OSM database. The results of all approaches are evaluated and visualised in choropleth maps (cf. Fig. 1).

The assumption of an incomplete and heterogeneous OSM building dataset is verified. Significant differences between urban agglomeration and rural areas can be observed. With regard to these results it can be concluded that the OSM building dataset cannot yet replace governmental data or proprietary data. However, it may already serve as a source for the semantic enrichment of existing datasets. This may potentially improve models for the estimation of socio-economic parameters within the field of urban development studies.

Keywords: OpenStreetMap, Building Data, ALK, ATKIS, Quantitative Comparison

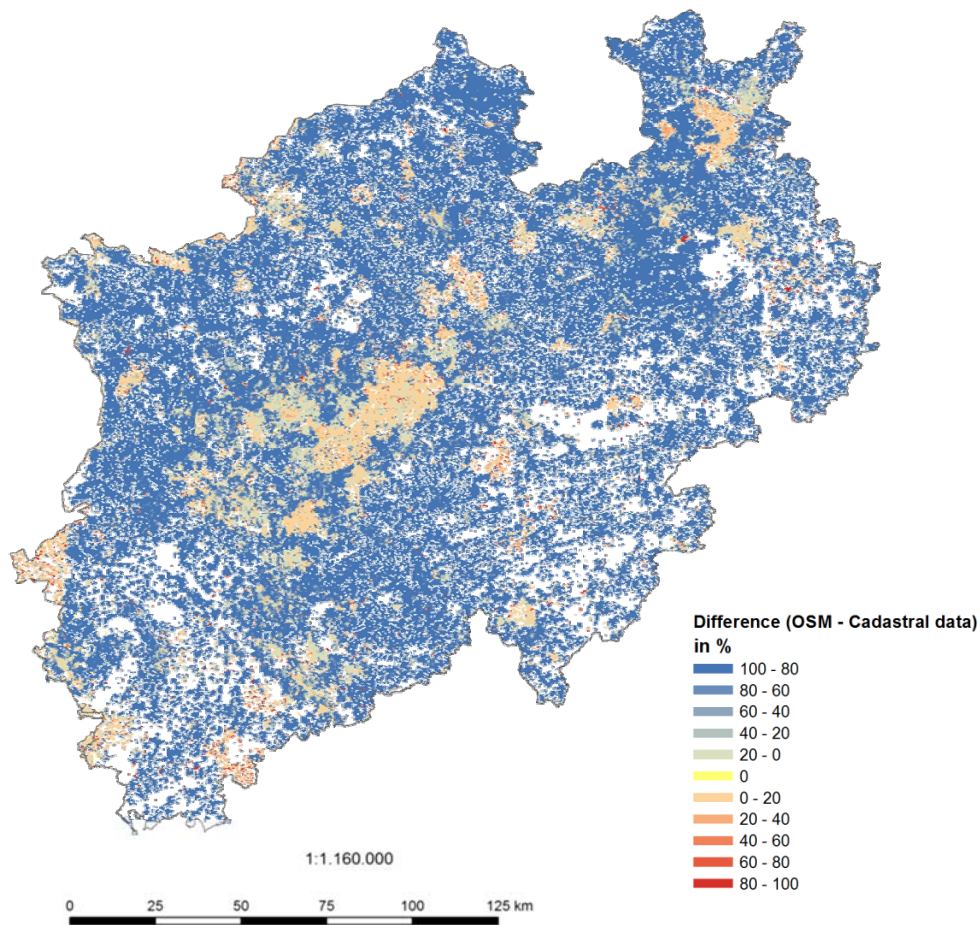


Fig. 1. A choropleth map visualising the differences of building areas in North Rhine-Westphalia (OSM vs. German cadastral data).

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